

**Litholapaxy / by Edward L. Keyes.**

**Contributors**

Keyes, E. L. 1843-1924.  
Royal College of Surgeons of England

**Publication/Creation**

New York : G.P. Putnam's Sons, 1880.

**Persistent URL**

<https://wellcomecollection.org/works/kkpvyce6>

**Provider**

Royal College of Surgeons

**License and attribution**

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

**wellcome  
collection**

Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>

10

# LITHOLAPAXY

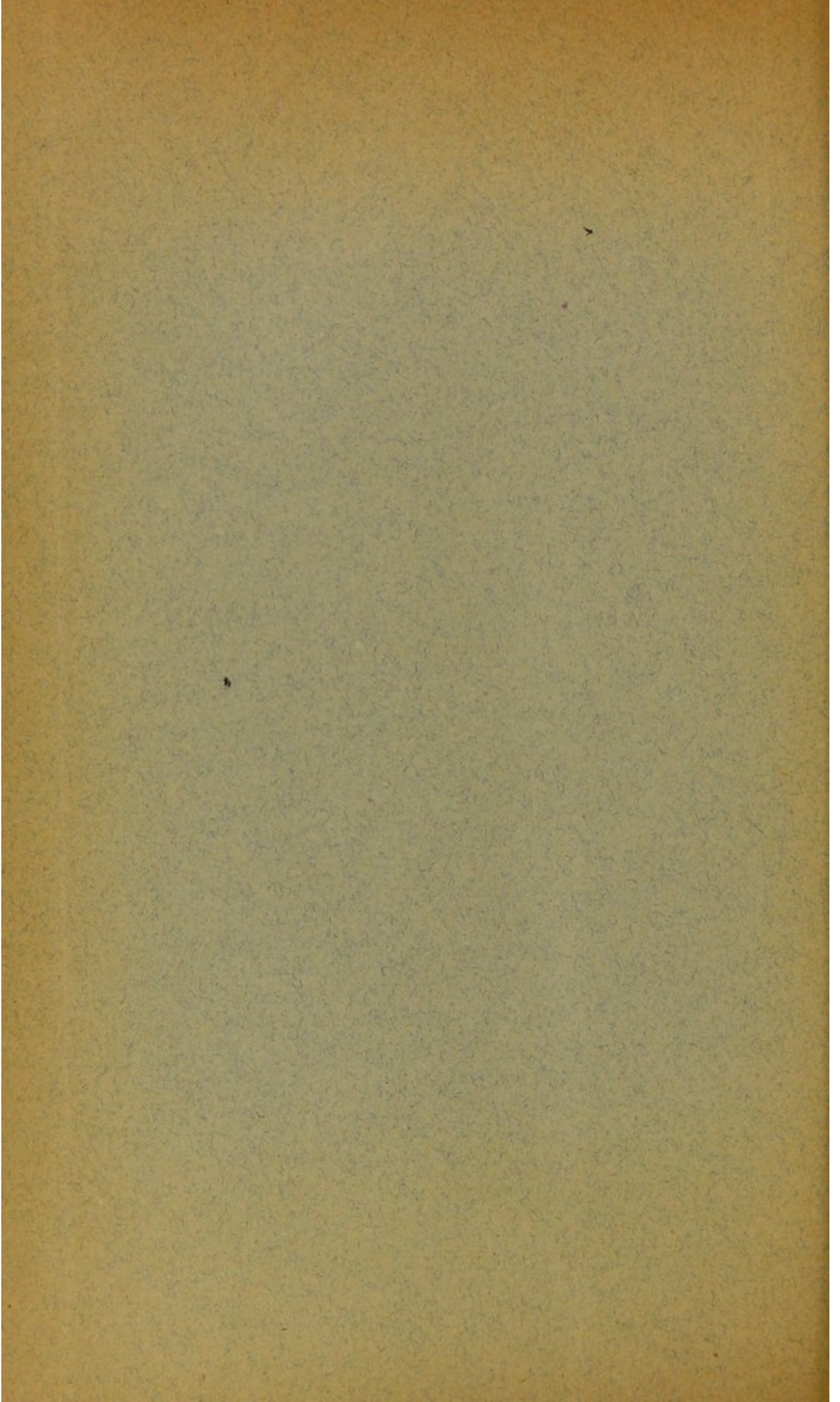
BY

EDWARD L. KEYES, M.D.

ADJUNCT TO THE CHAIR OF SURGERY, BELLEVUE HOSPITAL MEDICAL  
COLLEGE, SURGEON TO BELLEVUE AND CHARITY HOSPITALS,  
NEW YORK.

Reprinted from the ANNALS OF THE ANATOMICAL AND SURGICAL SOCIETY  
Brooklyn, Vol. ii, No. 6. 1880.

NEW YORK  
G. P. PUTNAM'S SONS  
182 FIFTH AVENUE  
1880





## LITHOLAPAXY.\*

By EDWARD L. KEYES, M. D.

ADJUNCT TO THE CHAIR OF SURGERY, BELLEVUE HOSPITAL MEDICAL COLLEGE, SURGEON TO BELLEVUE AND CHARITY HOSPITALS, NEW YORK.

**Y**OUR president has asked me to demonstrate to you upon the cadaver to-night that new method of removing stone from the bladder, to which the name litholapaxy has been given by its inventor.

I call the method new, because it was only introduced to the profession by Professor Bigelow in January, 1878. It is therefore less than two and a-half years old; but it is a sturdy baby, well able to walk alone, and its acquaintance has already been made by some of you.

Many of you, however, have doubtless not yet seen the operation done, and a demonstration of the details of operative procedure will therefore be interesting to you, and possibly of advantage to those among you who, being already familiar with the use of the lithotrite in the bladder in the performance of old-fashioned lithotrity, may desire to give your patients with calculus the benefit of the shorter road to cure.

I hope to show you to-night nearly everything of practical value which has been thus far accomplished in the

---

\* Delivered before the Society March 29, 1880.

Reprinted from the ANNALS OF THE ANATOMICAL AND SURGICAL SOCIETY  
Vol. ii, No. 6.

operation by Professor Bigelow and others interested in it, both in the way of instruments and manœuvres. The future probably contains much more than I can tell you now, especially in regard to instruments. For the operation is indeed largely a mechanical triumph, and further mechanical improvement in the apparatus is possible.

Special instruments possessing certain definite capabilities are absolutely essential to the performance of litholapaxy, and in this direction improvements are constantly being made, and will continue to be made for some time to come. The active mind of Dr. Bigelow is not yet satisfied with its achievements, and has devised within the past few months two new washing bottles, a modification in the toe of the female blade of the lithotrite, a new beak and a new handle for the searcher. All of these instruments I shall be able to show you to-night, together with Sir Henry Thompson's two washing bottles and tube, and other instruments which have been used in the operation.

QUESTION OF PRIORITY.—Litholapaxy is a new operation. To crush a stone partially and pump out the fragments is not litholapaxy, but lithotrity. Crushing a stone in some rude way and then and there evacuating the fragments was practiced, if we may believe history, so far ago as in the very beginning of the ninth century upon the old monk Theophenes. Civiale, the Fulton of lithotrity, first successfully applied his *litholabe* upon a living subject in January, 1824. The earlier operations of this pioneer in lithotrity were marked by the length of the sittings, and an effort to do, if possible, all the work at one time; but advance and improvement in the French method culminated in the rule that the instrument should not remain in the bladder more than two or three minutes in any given sitting, and the sittings were only repeated after an interval of several days.

Heurteloup, whose *percuteur*, the rough model of all subsequent lithotrites, was given to the world in 1832, habitually removed calculi at a single sitting, and with great success, since, in an essay written in 1847,\* he allows only three deaths in sixty-nine cases. Heurteloup, however, did not so impress the community as to make his method popular or universal.

Indeed all the early operators had in view the removal of the stone by lithotripsy as promptly as possible, and many of them devised special instruments for the purpose. The discharge of detritus was favored in some cases by the injection of water through a large-eyed catheter, but generally a sort of double scoop, which could be opened and brought together, was the instrument used to effect the extraction of small stones, and of the fragments of larger stones, after they had been perforated and broken up.

To such an extent was this alleged immediate extraction of stones and debris carried that in 1846, on April 27th, before the Académie des Sciences,† Leroy d'Etiolles claimed to be able to extract from the bladder in one sitting a stone thirty-five millimetres in diameter (a little over  $1\frac{1}{3}$  inch), and at the same meeting he boasted of success by the rapid operation and immediate extraction in more than a hundred cases.

Heurteloup, at this same meeting of the Academy in 1846, made a communication concerning a new instrument like his *percuteur*, except that its jaws were spoons, destined to extract small stones and the debris of large broken ones from the bladder; and in the following year, 1847, his rather pretentious volume, already alluded to (*De la Lithotripsie*,

\* *De la Lithotripsie sans fragments au moyen des deux procédés de l'extraction immédiate ou de la pulvérisation immédiate des pierres vésicales par les voies naturelles*, par le baron Heurteloup, 1 vol. 8vo. avec planches. Labé. Paris, 1847.

† *Comptes rendus des Séances de l'Académie des Sciences*, 1846, i, p. 704, and *Gaz. Med. de Paris*, May 2, 1846, p. 354.

etc.) appeared, in which he claimed such good success for rapid lithotrity with immediate extraction.

In view of these facts, it may well excite wonder that the idea of rapid lithotrity with immediate and complete evacuation did not gain favor in the early days of stone crushing, and that this idea was condemned and finally lost sight of. On the contrary, we find Civiale favoring short crushings, without evacuation, and with long intervals of rest, and doing so with increasing dogmatism, as prolonged experience in his high position rendered him master of his subject.

An explanation of all this seeming mystery becomes simple when the facts are better known.

Anæsthesia was not used when lithotrity was young. The earlier perforating and crushing instruments were imperfect in structure, the whole machinery, including the operating table, was mechanically complicated, and evacuation of detritus was usually attempted by dragging out through the sensitive urethra an instrument charged with debris. The instrument of course, had to be reinserted for each load it brought away.

When added to this, it is taken into consideration that the early champions of lithotrity had to contend not only with hostile advocates of the cutting operations and the great body of the conservative surgeons of the day, but also with each other, for their bickerings were disgracefully active, it becomes a matter of admiration that lithotrity ever succeeded at all in becoming established as a justifiable surgical procedure. That it did so succeed is due largely to the genius, the honest zeal and untiring patience of that master spirit Civiale.

Heurteloup, whose name generally stands second to that of Civiale in the history of lithotrity does not seem to have possessed either a scientific spirit or sound doctrine, while his instruments for withdrawing stone from the bladder are open to the objections already alluded to.

That Heurteloup was not broadly scientific is shown by the quality of his writings. He is constantly speaking of something undone which he has not yet in hand and which he proposes to publish at a later day. This reproach was made even of his famous monograph "de la Lithotripsie sans fragments, etc.," in 1847, by the reviewer in the *Archives Générales*.\* His narrowness is further shown by his treatment of Civiale to whom after first professing friendship, he became later bitterly hostile. It is shown by the secrecy which he maintained as to his methods and as far as possible his instruments, as attested by Civiale,† who quotes Rigal in confirmation of his statements.

That Heurteloup was unsound in doctrine is shown by his own writings; for in a book ‡ published in London, 1831, he states several times and emphasises it with italics, that it is not necessary after lithotrity to take away all the detritus; that the greater, coarser portions may be readily removed by his evacuating instrument, *and that what is left will dissolve in the urine.*

What more arrant heresy could have been emitted to damn lithotrity at its birth.

It is very clear that rapid lithotrity as performed by Amussat, by Leroy d'Etiolles, by Heurteloup, and others was an unsurgical procedure. Therefore it could not stand the test of experience by a wider trial in the hands of the general surgeon. Even Heurteloup gave up the effort toward the end of his career, and rapid lithotrity disappeared and bears no relation to the litholapaxy of Bigelow, which we are considering to-night.

Following lithotrity into England, we find scattered accounts of rude operations, but no very systematic adoption of lithotrity until after the visit of Heurteloup to London,

\* 1874, xv, 4th series, p. 141.

† *Traité de la Lithotritie*, 1847, p. 448.

‡ *Principles of Lithotrity*, London, 1831.



at which time he secured a number of successful cases and published the treatise already alluded to. After this, a number of surgeons took up the operation which gained in favor, and finally secured the sturdy advocacy of Sir Henry Thompson, who became its apostle and a recognized authority upon all questions bearing upon the operation.

Thompson followed the conservative gentle methods of Civiale and acquired an enormous experience. In March, 1878, in an admirable paper before the Royal Medico-Chirurgical Society of London,\* he presented an analysis of 500 personal cases of removal of stone from the male adult. At this time he favored short intervals between the crushings, and was inclined to leave to lithotomy such stones as could not be crushed in three or four sittings. In cases where cystitis followed the crushings, due to sharp fragments of stone left in the bladder, Thompson had come to consider it advisable to give ether and remove all the debris with Clover's evacuating bottle.

The general tone of the discussion at this meeting of the Society, went to show that in the minds of the best English surgeons, lithotrity had been pushed up to its justifiable limits and that probably in the future it would be well to leave more stones to lithotomy, reserving lithotrity for cases in which the size of the stone was such that few sittings would be called for, and the bladder might be promptly freed of the detritus.

Matters stood at about the same level in this country at this time. The advocates of the median and supra-pubic cutting operations were pushing the claims of their methods for supremacy, and lithotrity had but few serious supporters.

Now a new departure has been taken. Bigelow's operation is gaining favor in England and in this country. The

---

\* London Lancet, March 16, 1878, p. 385.

names of new surgeons constantly appear in the journals with successful cases advocating the operation. Thompson has practically adopted the suggestions of the method, and in a recent issue of the *Lancet*,\* gracefully acknowledges the value of the improvement which Bigelow instituted.

Thompson had been working in the same direction and teaching the value of rapid work, short intervals and prompt removal of debris, using ether more freely and shortening the total duration of the treatment, but it fell to the lot of Bigelow to consummate the plan and crystallize the operation into a distinct new method, litholapaxy, which now promises in the adult male to displace ordinary lithotrity almost entirely, and to force lithotomy into a position of minor importance.

Litholapaxy may be defined as an operation which aims at prompt entire fragmentation of calculous material in the bladder with immediate and entire removal of the debris by aspiration through a tube passed by the urethra, disregarding the length of time employed in the operation, so long as the patient's general condition is good.

The same motives which would arrest any other operation before its completion hold with equal force here, but if the general condition of the patient is good, and a fragment of any considerable size remains, the operation may be continued according to Bigelow without regard to time until the desired result is obtained, and no harm is likely to come to the patient from the prolonged manipulation of the bladder, provided the different operative manœuvres be conducted with becoming gentleness, and no unnecessary violence be inflicted upon the bladder or urethra.

This operation, so defined, is new. Professor Bigelow naturally prefers his own instruments for its execution, but they are not essential. With or without an anesthetic, any

---

\* January 17, 1880.

lithotrite may be used, any evacuating catheter, any washing bottle, and the operation remains the same, providing the aim of the operator is to relieve the bladder entirely of debris by aspiration, without taking into serious account the length of time consumed.

Stokes, \* of Dublin, on December 5, 1879, read a paper before the Surgical Society of Ireland, reporting his first case of Bigelow's operation, in which he successfully removed 56 grains of stone from a patient in one hour and ten minutes. He stated that Bigelow's operation was performed in the Meath Hospital many years ago by Sir Philip Crampton, showing the original instrument, and claiming that the principle of its action is the same as that of Bigelow.

This statement, however, is not justified by a perusal of Sir Philip's admirable paper on lithotripsy which he delivered at the opening of the Meath Hospital. The paper appeared in the *Dublin Quarterly*, 1846, vol. i, p. 1, and the apparatus is described in it.

Crampton's evacuating bottle was devised to get detritus out of an atonied bladder, and was not designed for use upon the healthy organ. It was a strong oval glass vessel capable of holding a pint and a half, with a metal tube attached of one half inch bore furnished with a stop-cock. From this receptacle the air was drawn out by an exhausting syringe. One of Heurteloup's wide-eyed steel evacuating catheters was then introduced into the atonied bladder full of water in which a stone had been crushed, and, being coupled to the receiver, the stop-cock was turned and the contents of the bladder and the detritus were sucked out. The editor of the journal states in a note † that he saw in this manner two drachms of pulverized calculus drawn out at one time, "the experiment" being a "complete success."

---

\* *Brit. Med. Journ.*, Feb. 7, 1880, p. 210.

† Page 22.

A successful operation upon a Mr. Rodger, past 70 years of age, is also chronicled. Mr. Rodger had an atonied bladder, and had been previously operated upon by Heurteloup without entire success.

How little this method is like that of Bigelow is shown by Sir Philip's caution about throwing water into the bladder. He states that great care is necessary not to introduce fluid too rapidly into the bladder, since "more than one fatal case" had "arisen from this cause." The water he believed should be thrown slowly into the bladder, imitating the descent of urine from the kidneys.

There is one feature of all former injecting and evacuating apparatus which destroys the claims of their inventors for priority over Bigelow. They were designed in the main to assist nature when the bladder was atonied, not to substitute nature when the bladder was strong. Catheters of all sorts have been used from the earliest time, and more or less debris came through them.

Heurteloup's large-eyed steel catheter with a large jointed stylet is still used. Leroy d'Etiolles, Cornay, Mercier, Nélaton, Maisonneuve, Clover, Coxeter and others devised evacuating tubes of more or less value. With these were used syringes and rubber bulbs and exhausted air bottles and aspirating pumps, but they were generally condemned except for occasional use, and were more particularly reserved for cases in which the bladder had lost its own evacuating force from atony. Clover's bottle, which has perhaps received more general use than any other, might reasonably well execute litholapaxy, but it was not designed for that purpose, and has been displaced by several better washers.

Cornay's *lithérétie*, described and pictured by Mercier,\* is an instrument much like that of Sir Philip Crampton, already described, but superior in that it combined injection

---

\* *Traitment préservatif et curatif des sédiments, de la gravelle, etc.* Paris, 1872, p. 372.

through a double-current catheter with pneumatic aspiration. A description of this instrument appeared in 1845, Sir Philip's in 1846. Neither of them aimed at executing litholapaxy, as I have defined it.

The nearest approach to Bigelow's washing bottle with which I am familiar is the instrument devised by Mercier, and pictured by him in his treatise already referred to at page 373. It has the same rubber bulb and a similar glass receiver below it as Bigelow's first washer possessed. It was filled with water, attached above to a flexible catheter, worked by alternate compression and relaxation of the rubber bulb (without valves), and the detritus was collected in the glass receiver below just as it is in Bigelow's and in Thompson's washers; but Mercier expressly states (page 370) that he devised his washer to meet the same requirements for which other washers had been constructed, and to be used "quand la rétention devient complète," in short for cases of atony, for patients who were unable to rid their own bladders of the debris of a broken stone by muscular contraction—litholapaxy was not contemplated by Mercier.

Sir Henry Thompson's excellent washers were devised to do exactly what Bigelow's instrument had done, to rid the bladder of debris under all circumstances, and these bottles performed their function exceedingly well, and more agreeably at my hands than the first washer of Bigelow. Bigelow's last washing bottle\* I have not yet used upon the living subject. Its mechanical design seems perfect, and it undoubtedly does its work well.

I shall not detain you longer with matters of history, interesting though they are, but proceed to show you the instruments which have been employed and are now in use, and to demonstrate the action of the same upon the cadaver.

---

\* *Boston Med. and Surg. Journal.* 1880. Jan'y 8, p. 25.

I have recently furnished an article upon litholapaxy, detailing in full my experience with the method, giving statistics and a tabulated analysis of cases, together with all the deaths on record and certain practical suggestions gathered from my experience. This article will appear in a few days in the April issue of the American Journal of Medical Sciences. It is unnecessary for me to repeat here what may be read there, and I must refer those of you who are interested in the subject to that source for some practical points upon the operation in the way of manœuvres and results which lack of time forbids me to enter upon here.

MORTALITY.—In that article are collated 107 operations with 6 deaths. Since the manuscript went to press (Feb. 15th) I have learned of 13 other successful cases. One of these was a published case of Dr. Caswell, of Providence,\* which I omitted to record. 12 are new cases, most of which have appeared in print. This makes a total of 120 operations with 6 deaths, one in twenty cases, a mortality of exactly five per cent. for all operations taken together, a result which probably could not have been reached by the same surgeons upon the same patients by any other operation, since the average age of the patients was high—certainly over 55 years.

TIME TO BE EMPLOYED.—Regarding the amount of time which may be employed to perform the operation something may be said.

When Professor Bigelow announced the operation to the surgical world much doubt was felt as to the advisability of subjecting the bladder to prolonged manipulation. A cardinal maxim in lithotrity at that time was to make the sitting short, to leave instruments in the bladder for as short a time as possible, and it was a rude shock to the lithotritists of the day to be told that they might work

---

\* Boston Medical and Surgical Journal, Jan. 29, 1880, p. 101.

for two or three consecutive hours in the bladder without harming the patient. In a conversation recently, Professor Bigelow remarked to me that it made no difference if the operation lasted a week, indicating his entire disregard of time as an element to be considered in the operation. Bigelow, from the first, has maintained that rapid lithotrity should be done slowly.

In this statement he is certainly correct, for by slowly he means deliberately, carefully, disregarding time as an element of the operation. By such a method of operation alone can that gentleness of manipulation be assured which shall spare the bladder and urethra as much violence as possible. But when this gentleness of manipulation has been attained nothing more can be expected from slowness and deliberation in operating. Other things being equal the more expert the operator, the more rapidly will he finish his work, using the same or greater gentleness than another whose touch is less familiar with the business in hand. Prolonged etherization alone is harmful to some patients, and if only on this account brevity in the operation is desirable. That Bigelow believes this is shown by the large size of the tubes he advocates and habitually employs. Thompson, who has performed rapid lithotrity more often than any one else, has gradually extended the limit of time, he is willing to allow for an operation. His last utterance places it at about half an hour, but the wonderful dexterity of this veteran operator would ensure him a yield in a half hour possibly twice or three times as large as the general surgeon could aspire to in the same time, and for the general surgeon the caution is a wise one that no sacrifice of patient gentleness is allowable in this operation in order that few or many minutes may be saved. My experience has taught me that an operator reasonably well versed in the old method may find great variations in regard to time with

the new method, but should expect to average about 5 grains of dried stone for every minute of operation, especially if the stone be large, and should reach a higher average yield with acid than with alkaline stones. Thompson's average yield as published is  $16\frac{1}{2}$  grains to the minute for acid stones,  $12\frac{1}{2}$  grains for phosphatic stones. Thompson does not lose any time searching for last fragments. He prefers a supplementary sitting, and this with his marvellous dexterity of manipulation, has given him a very high average.

Bigelow, who practically disregards the element of time and whose first published series of cases gave the small average of three grains to the minute, informed me recently that in a favorable case, one of his last, where he had the operation timed for curiosity, he succeeded in evacuating between 750 and 800 grains of stone in 20 minutes. This was a phosphatic stone and is, I believe, the most rapid operation on record. The conditions must have been very favorable to have yielded 40 grains to the minute.

The most rapid case on record of simple evacuation without crushing, is that of Mr. Thomas Smith,\* who washed out three ounces of small stones in 20 minutes from the bladder of a patient, and at a second operation upon the same individual got one ounce with crushing and washing in 24 minutes, an average of 72 grains for each minute of the first operation. This patient recovered, and has been recently reported in the *Lancet* as doing well.

The conclusions to which my experience in litholapaxy have thus far led me, are roughly as follows: I state them briefly as general conclusions which future experience may modify.

1. Litholapaxy is applicable to all stones in the adult capable of being broken by an instrument which can pass

---

\* *London Lancet*, Jan. 10, 1880, p. 44.



the urethra. Multiple stone is rather an advantage than otherwise where there is much calculous material.

2. Stricture does not contra-indicate the operation. If near the meatus it may be cut at the time of crushing the stone. If deeper it should be cut or stretched by preparatory treatment.

3. Prostatic hypertrophy is no bar to the operation so long as solid instruments of reasonable size can be made to enter the bladder without the use of force.

4. Age is no bar to the operation.

5. Inflammatory conditions of the bladder do not contra-indicate the operation, although, undoubtedly, a reasonably healthy bladder furnishes a better field.

6. Chronic Bright's disease, heart disease and general debility do not so seriously contra-indicate this operation as they do others upon the urinary tract and may be almost disregarded, unless so far advanced as to make any other surgical manœuvre upon another part of the body undesirable. Preëxisting pyelitis is the gravest complication which can (immediately) compromise the success of the operation.

7. The operation should not be undertaken without a large previous experience upon the dead body or a small experience upon the living subject with old-fashioned slow lithotrity without ether.

8. A lithotrite which cannot be made to clog, will not readily catch the bladder, and is as small as will satisfy the requirements of the stone as to size and hardness is desirable. The tubes may be straight or curved as large as the urethra will admit comfortably after cutting the meatus if necessary, and any efficient washing bottle can be used which may suit the operator's fancy if it be a bottle which will not allow air, which may have accidentally entered the bladder, to remain there.

9. A surgeon should not undertake the operation unless he feels confident that he can recognize the fact at once if he catches the bladder, so that he may drop the fold of mucous membrane immediately without bruising it.\*

I here show you a number of specimens of stone removed by litholapaxy that you may inspect the size and general quality of the fragments. The age of the patient, the time of the operation and the weight of the debris are marked upon each bottle.

Most of these instruments which I now hand around have been abundantly described in various places. The only new ones which need a few words of description are the lithotrite, the washing bottle, the searcher, and the washing tube.

The washing bottle is nearly but not quite the latest model of Prof. Bigelow.

This one has already been described in print.† I have not yet tried it upon the living subject. It is said to work very well. The modifications now being made are to discard the spherical shape of the receiver and return to the older shape, which is certainly preferable in that it allows inspection of fragments, as they drop into the receiver. Such inspection is difficult in the spherical receiver if the water be tinged with blood.

A new arrangement of suspension of the new bottle is contemplated, but its essential mechanical structure in all the features relating to its function remain unaltered.

The lithotrite I here show you is the very latest model devised by Dr. Bigelow. It was only finished last week. It varies from former models in having an extra forward

---

\* The lecturer here demonstrated upon the cadaver, the ease with which the bladder may be picked up in the jaws of the lithotrite, succeeding without difficulty in catching the bladder with Bigelow's lithotrite, with his own instrument and with other instruments. He believed the bladder of a dead man to be no more loose and flabby than the atonied bladder of a live old man with a large prostate.

† Boston Medical and Surgical Journal, Jan. 8., 1880.

curve at the toe of the shoe of the female blade, (this is for convenience of introduction), and two new spurs upon the sole of the male blade, for the evident purpose of making its prehensile power greater.

The searcher which I now pass around has the same forward curve at its beak, giving the tip of the instrument an S shape which may be called the Bigelow curve. There is a ball like that of the lithotrite to grasp while searching; and a hard rubber corrugated cylinder with another smooth one of metal upon the shaft near the ball. The new tube is a straight one modified by Warren with the spiral tip, which I here show you.

PREPARATORY TREATMENT.—I think it better in all cases where inflammatory symptoms are at all active, that the patient should rest in bed for a few days before the operation is undertaken, drinking freely of Bethesda or Poland water, or taking a milk diet with a little of some bland alkaline diuretic, such as the citrate of potash.

If the urine be acid and reasonably clear, this is all the preparatory treatment required. Should the urine be ammoniacal, putrid, highly purulent, especially if atony of the bladder coexists with decomposition of the urine, the bladder should be washed out once or twice a day with a strong solution of borax in hot water, a tablespoonful (more or less according to the patient's sensibilities), of borax to the pint of water at above 38° C. (100° F). Benzoic acid or one of the benzoates may be administered by the mouth at the same time, if the stomach be vigorous, otherwise I prefer Bethesda or Poland water in free doses, from one to three pints a day.

In any case the urethra should be thoroughly tested with a smooth steel sound of large size to insure its patency, and that the operator may become familiar with any peculiarities of the canal.

None of this preparation is absolutely necessary, but it is desirable. On more than one occasion I have gone out of town to operate upon a patient who had no preparatory treatment and with the happiest result. But I have always gone prepared for any emergency.

Such ordinary treatment as the use of quinine and what anodyne may be required, is governed by the rules applicable to all cases of urinary surgery.

AFTER TREATMENT.—The after treatment is equally simple. The catheter may be required to relieve temporary retention of urine, the washings with borax are indicated in all conditions of atony or where the urine has been previously putrid in any degree, otherwise nothing is usually called for except a little quinine, more or less anodyne for a few days, a continuance of Bethesda water or the alkaline diluent, and rest in bed for perhaps a week. I am accustomed to assure a patient that if all goes reasonably well, he will be up and about in one week after his operation.

A final wash and search for possible last fragments can not be omitted after the patient is up and about before dismissing him as cured.

THE OPERATION.—The present method of operating followed by Dr. Van Buren and myself, is the following: The patient is left upon his back on his bed, which for the convenience of the operator, should be a high one. His hips are raised a little upon a pillow, and a rubber cloth is placed beneath him. One assistant attends to the ether, another to the washing bottle. No other assistants are necessary, unless the case is one of those exceptional patients who do not lie quiet, or who become rigid under an anæsthetic. In such cases two more assistants are necessary to hold the knees quietly apart.

If the urine has been ammoniacal and decomposed, the first step in the operation is to introduce a tube, and after

having drawn off the urine, thoroughly wash out the bladder with a warm solution of borax. A little of this wash is left in the bladder and the crushing is then carried out according to ordinary rules, from six to twelve seizures being made in rapid succession until a fair amount of detritus has been created. Then the tube is introduced and the bladder washed so long as fragments continue to fall freely into the receiver, changing the position of the end of the tube in the bladder from time to time. The lithotrite is reintroduced and the washing repeated until the bladder is empty of stone. A little fine dust may remain and come away during urination, or even a small fragment may be overlooked or left behind knowingly, rather than prolong the operation greatly; I will show you the reason for this by washing in a flask presently. A large fragment should not be left behind, a small one or several of them do not inconvenience the patient or interfere with his prompt recovery from the operation, and much unnecessary time may be consumed in attempting to get it out.

[The lecturer now proceeded to demonstrate the operative manœuvres upon the cadaver and in glass flasks, prepared with a thin rubber cover over their mouths, tied tightly around the tubes so as to represent the contractile quality of the bladder as nearly as possible, and yet allow an inspection of the fragments as they were being washed out. All the various customary manœuvres were shown and the different instruments tested.]